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A new species of *Nephroma* (*Nephromataceae*) from the Tibetan Plateau

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Abstract — A new species, *Nephroma flavorhizinatum*, is described from the Tibetan Plateau. This species is characterized by marginal and laminal lobules, an obvious pruina, a white to golden yellow medulla, a golden yellow rhizinal base, and a unique chemistry.

Key words — China, lichen, *Peltigerales*, taxonomy

Introduction

Nephroma Ach. is the only member of the lichen family *Nephromataceae* (*Peltigerales*, *Lecanoromycetes*, *Ascomycota*) (Kirk et al. 2008). The genus is morphologically characterized by a cyanobacterium (*Nostoc*) or a green alga (*Coccomyxa*) photobiont, a coriaceous foliose thallus with cortex on both surfaces, a kidney-shaped apothecium at lobe apices of the lower surface, an 8-spored ascus, and often 3-septate pale brown ascospores (James & White 1987, White & James 1988, Burgaz & Martínez 1999, Brodo et al. 2001, Wetmore & Nash 2002, Louwhoff 2009). Most *Nephroma* species contain a variety of lichen substances, including hopane triterpenoids, phenarctin, usnic acid, perlatolic acid derivatives, anthraquinones, or other pigments (James & White 1987).

Nephroma is a cosmopolitan genus of 36 species worldwide (Kirk et al. 2008). In the southern temperate zone, Australia, North America, Europe, Macaronesia, and South Korea, the species of *Nephroma* were studied systematically (Wetmore 1980, Tønsberg & Holtan-Hartwig 1983, James & White 1987, White & James 1988, Park 1990, Goward & Goffinet 1993, Burgaz & Martínez 1999, Brodo et al. 2001). In China, nine *Nephroma* species were reported: *N. helveticum*, *N. isidiosum*, *N. javanicum*, *N. moeszii*, *N. parile*, *N. resupinatum*, *N. sinense*, *N. subparile*, and *N. tropicum* (Wei 1991).

During our study of the lichen flora of the Tibetan Plateau, an interesting species of *Nephroma* new to science was found.

Materials & methods

The specimens studied were collected from Sichuan, China, and are preserved in SDNU (Lichen Section of Botanical Herbarium, Shandong Normal University). The morphological and anatomical characters of the specimens were examined using a stereo microscope (COIC XTL7045B2) and a microscope (OLYMPUS CX21). Lichen substances in all specimens cited were identified using the standardized thin layer chromatography techniques (TLC) with G system (Culberson et al. 1981). Photos of the thallus were taken under OLYMPUS SZX12 with DP72.

Taxonomy

Nephroma flavorhizinatum Q. Tian & H.Y. Wang, **sp. nov.** Figs 1, 2

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Lobus crenatus. Lobulus marginalis et laminalis. Medulla alba ad flava. Rhizina flava ad basis. Phycobiont Nostoc. Thallus T1, T2 et T4 continens.

Type collection: CHINA. Sichuan province, Litang, alt. 4200 m, on ground, Z. S. Sun, 20080755, 5 Nov. 2008. (**Holotype** in SDNU).

Expanded description —Thallus foliose, coriaceous, about 4 cm in diameter. Lobes irregular, usually 2–10 mm wide, often ascending at the margins, crenulate or with lobules. Upper surface brown, smooth; isidia and soredia absent; lobules marginal and laminal, usually 0.2–1 mm wide, developing from isidioid papillae, immediately becoming flat, some of them branched; pruina white, at the margins of lobes and the dorsal surface of apothecia. Photobiont *Nostoc*. Medulla white to golden yellow. Lower surface dark brown, tomentose, paler and smooth at the margins; rhizines about 3 mm long, brush-like, golden yellow at the bases, white at the tips. Apothecia common, immersed on lower surface at tips of lobes, kidney-shaped, usually erect; disc dark brown, 1–4 mm in diameter; dorsal surface often with short tomentum; margins usually entire, rarely crenulate or with lobules. Asci 8-spored; ascospores pale brown, 3-septate, 15–20 × 3.5–5 μm. Pycnidia not seen.

Spots tests—Thallus upper surface: K–, C–, KC–, PD–; white medulla: K–, C–, KC–, PD–; golden yellow medulla: K+ violet, C–, KC–, PD–; rhizinal base: K+ violet, C–, KC–, PD–; rhizine tip: K–, C–, KC–, PD–.

Secondary metabolites—7β-acetoxyhopan-22-ol (T1), 15α-acetoxyhopan-22-ol (T2), hopane-7β,22-diol (T4).

Distribution and substrate —*Nephroma flavorhizinatum* is a terricolous species, at present known only from the type locality.

Additional specimens examined —CHINA. Sichuan: Litang. alt. 4200 m, on soil, 5 Nov. 2008, Z.S. SUN 20084011 & 20103317 (SDNU).

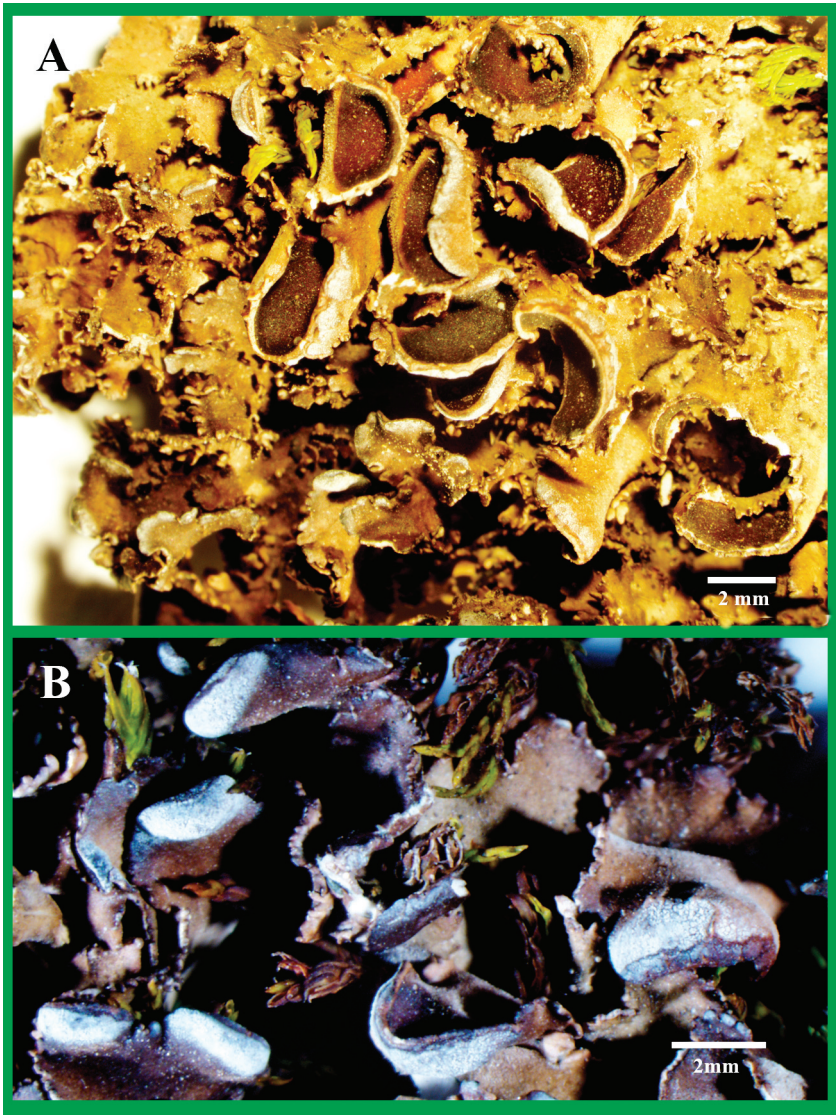

Fig. 1 *Nephroma flavorhizinatum* (holotype).
A. Thallus. B. Pruina at the dorsal surface of apothecia. (Scale bars = 2 mm).

Comments—The presence of laminal and marginal lobules, a white to golden yellow medulla, a golden yellow rhizinal base, and the unique chemical characters distinguish *Nephroma flavorhizinatum* from all other *Nephroma*

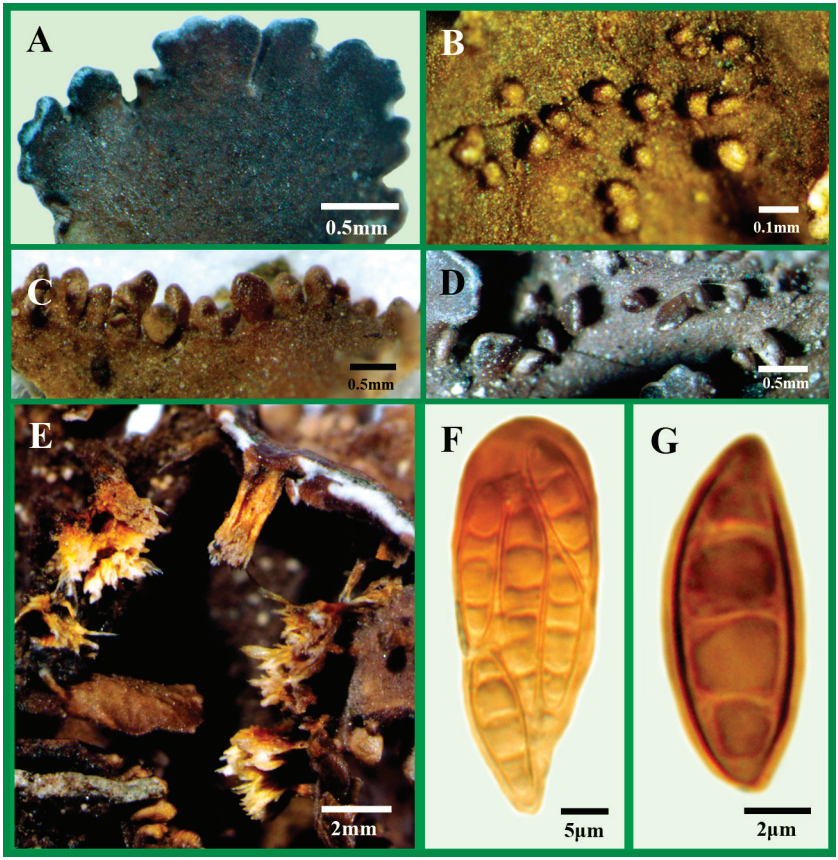

Fig. 2 *Nephroma flavorhizinatum* (holotype).
A. Crenulate lobe. B. Developing laminal lobules. C. Marginal lobules.
D. Developed laminal lobules. E. Rhizines: golden yellow at the bases, and white at the tips.
F. 8-spored ascus. G. 3-septate ascospore.
(Scale bars: A, C, D = 0.5 mm; B = 0.1 mm; E = 2 mm; F = 5 μm; G = 2 μm)

species. Many *Nephroma* species have laminal lobules (phyllidia or folioles), but most *Nephroma* species have no rhizines. *N. isidiosum*, *N. kuehnemannii* and *N. microphyllum* are rhizinate. However, *N. isidiosum* and *N. kuehnemannii* have no laminal lobules, and the former is isidiate, the latter is lichenized with green algae. *N. microphyllum* has laminal lobules, but its ascospores are 5–8-septate rather than 3-septate, and longer than the new species (70–90 μm vs. 15–20 μm). Moreover, the medulla and rhizines of all the three *Nephroma* species mentioned above are white rather than golden yellow. *N. analogicum,*

N. chubutense, *N. laevigatum*, *N. tangeriense*, and *N. venosum* all have white to yellow medulla and lobules. However, these five species are not rhizinate, and their lichen substances are different from the new species.

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